

Claims

[c1] What is claimed is:

- 1.A multiple step-sized levels adaptive method for time scaling to synthesize an $S_3[n]$ signal from an $S_1[n]$ signal and an $S_2[n]$ signal, the method comprising:
 - (a) calculating a first magnitude of a cross-correlation function of the $S_1[n]$ signal and the $S_2[n]$ signal according to a first index;
 - (b) comparing the first magnitude with a threshold value;
 - (c) if the first magnitude is smaller than the threshold value, calculating a first reference magnitude of the cross-correlation function of the $S_1[n]$ signal and the $S_2[n]$ signal according to a first reference index behind the first index by a first determined number, or calculating a second reference magnitude of the cross-correlation function of the $S_1[n]$ signal and the $S_2[n]$ signal according to a second reference index behind the first index by a second number; and
 - (d) synthesizing the $S_3[n]$ signal by adding the $S_1[n]$ signal to the $S_2[n]$ signal in accordance with a maximum index corresponding to a largest magnitude among all of the magnitudes calculated in step (c).

[c2] 2.The method of claim 1 wherein in step (d) the $S_1[n]$ signal is weighted and added to an $S_4[n]$ signal that lags the $S_2[n]$ signal by the maximum index to form the $S_3[n]$ signal.

[c3] 3.The method of claim 2 wherein the $S_1[n]$ signal has N_1 elements while the $S_2[n]$ signal has N_2 elements, and the $S_3[n]$ signal
= the $S_1[n]$ signal, where $0 \leq n <$ the maximum index;
= $(N_1 - n)/(N_1 - \text{the maximum index}) * S_1[n] + (n - \text{the maximum index})/(N_1 - \text{the maximum index}) * S_4[n - \text{the maximum index}]$, where the maximum index $\leq n < N_1$;
= $S_4[n - \text{the maximum index}]$, where $N_1 \leq n \leq N_2 - \text{the maximum index}$.

[c4] 4.The method of claim 1 wherein step (c) further comprises:
(e) setting each of the magnitudes corresponding to indexes between the first index and the first or second reference index to zero.

[c5] 5.The method of claim 1 further comprising:
(f) updating the threshold value according to the maximum index.

[c6] 6.The method of claim 1 wherein the $S_1[n]$ signal and the $S_2[n]$ signal are sampled from an $S_1(t)$ signal and an $S_2(t)$

signal respectively.

- [c7] 7.The method of claim 6 wherein the $S_1(t)$ signal and the $S_2(t)$ signal are both derived from an original signal.
- [c8] 8.The method of claim 7 wherein the original signal is an audio signal.
- [c9] 9.The method of claim 7 wherein the original signal is a video signal.
- [c10] 10.The method of claim 7 wherein the $S_1(t)$ signal and the $S_2(t)$ signal are identical.
- [c11] 11.The method of claim 7 wherein the $S_1(t)$ signal and the $S_2(t)$ signal are different from each other.
- [c12] 12.The method of claim 1 wherein the second number is equal to one.
- [c13] 13.The method of claim 1 wherein the first determined number is larger than one.
- [c14] 14.A multiple step-sized levels adaptive method for time scaling to synthesize an $S_3[n]$ signal from an $S_1[n]$ signal and an $S_2[n]$ signal, the method comprising:
 - (a) delaying the $S_1[n]$ signal by a predetermined number to form an $S_5[n]$ signal;
 - (b) calculating a first magnitude of a cross-correlation

function of the $S_1[n]$ signal and $S_5[n]$ signal according to a first index;

- (c) comparing the first magnitude with a threshold value;
- (d) if the first magnitude is smaller than the threshold value, calculating a first reference magnitude of the cross-correlation function of the $S_1[n]$ signal and the $S_2[n]$ signal according to a first reference index behind the first index by a first determined number, or calculating a second reference magnitude of the cross-correlation function of the $S_1[n]$ signal and the $S_2[n]$ signal according to a second reference index behind the first index by a second number; and
- (e) synthesizing the $S_3[n]$ signal by adding the $S_1[n]$ signal to the $S_2[n]$ signal in accordance with a maximum index corresponding to a largest magnitude among all of the magnitudes calculated in step (d).

[c15] 15. The method of claim 14 wherein in step (e) the $S_1[n]$ signal is weighted and added to an $S_4[n]$ signal that lags the $S_5[n]$ signal by the maximum index plus the predetermined number to form the $S_3[n]$ signal.

[c16] 16. The method of claim 15 wherein the $S_1[n]$ signal has N_1 elements while the $S_2[n]$ signal has N_2 elements, and the $S_3[n]$ signal equals:
= the $S_1[n]$ signal, where $0 \leq n < (\text{the predetermined number} + \text{the maximum index})$;

= $(N_1 - n) / (N_1 - (\text{the predetermined number} + \text{the maximum index})) * S_1[n] + (n - (\text{the predetermined number} + \text{the maximum index})) / (N_1 - (\text{the predetermined number} + \text{the maximum index})) * S_4[n - (\text{the predetermined number} + \text{the maximum index})]$, where $(\text{the predetermined number} + \text{the maximum index}) \leq n < N_1$;
= $S_4[n - (\text{the predetermined number} + \text{the maximum index})]$, where $N_1 \leq n \leq (N_2 + \text{the predetermined number} + \text{the maximum index})$.

- [c17] 17. The method of claim 14 wherein step (d) further comprises:
 - (f) setting each of the magnitudes corresponding to indexes between the first index and the first or second reference index to zero.
- [c18] 18. The method of claim 14 further comprising:
 - (g) updating the threshold value according to the maximum index.
- [c19] 19. The method of claim 14 wherein the second number is equal to one.
- [c20] 20. The method of claim 14 wherein the first determined number is larger than one.